Intonational patterns, tonal alignment and focus in Mawng.

Sam Hellmuth, Frank Kügler and Ruth Singer

1 Introduction

This paper provides an overview of the general intonational properties of Mawng together with an analysis of the main Mawng pitch accent in both neutral and focus contexts, by means of a corpus-based quantitative alignment study. Mawng is a non-Pama Nyungan language of the Iwaidjan language family, spoken in North-west Arnhem land, Northern Territory, Australia. It is the main language of daily communication for at least 300 people, including children. Mawng is part of the Iwaidjan language family, and the only other language in the family that is still spoken is Iwaidja. The non-Pama Nyungan language whose intonation is best described is Bininj Gun-wok, which is part of the Gunwinyguan family[1]. Iwaidjan and Gunwinyguan languages are spoken in adjacent areas but are only distantly genetically related to one another (Evans 2000).

All of the data investigated here were collected at Warruwi (Goulburn Island) where the majority of Mawng speakers currently reside. The main dataset used consists of spontaneous narratives as well as elicited material collected for a wider investigation into the expression of information structure in Mawng (Singer, in preparation); the data were collected with six different speakers. At present we set out in section 2 the results of a first preliminary survey of the intonational properties of Mawng, whose purpose was to determine the correct parameters to include in a more detailed systematic survey of a selected corpus (currently in progress). We hope to include the results of the systematic survey in a later version of this paper. In section 3 we examine more closely the properties of the most commonly observed Mawng pitch accent in its non-focus and focus variants; the study is quantitative in nature, based on measurements extracted from suitable tokens identified in the main dataset.

2 The intonational system of Mawng

2.1 Global intonational contours observed in our data

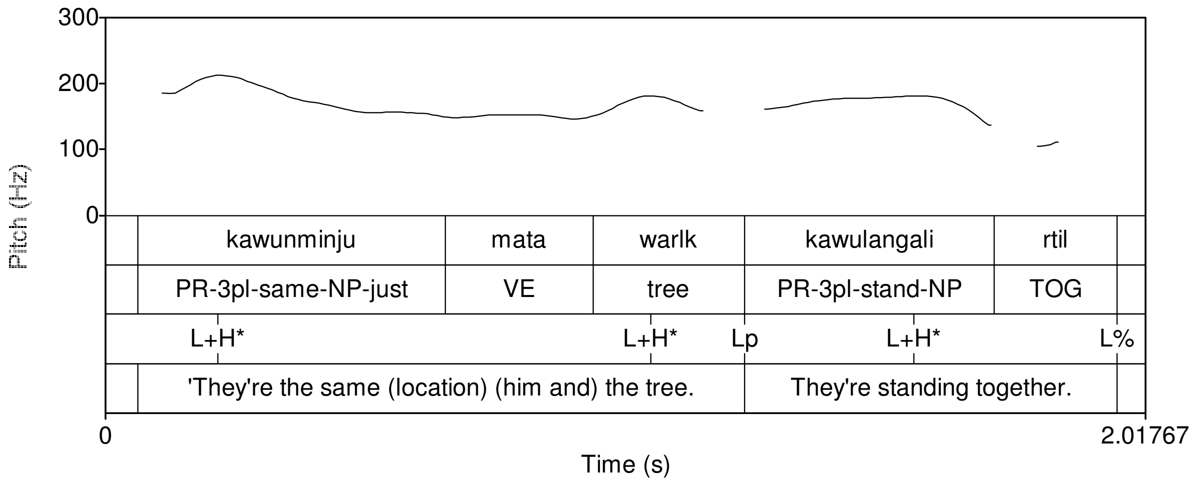
In most contexts Mawng displays a global declination pattern through the phrase, with subsequent accents slightly downstepped to each other. This regularity of this pattern facilitates identification of utterance-internal phrase boundaries, which often interrupt the declination pattern (see section 2.2.2 below). Both culminative and demarcative pitch events are found on or near the stressed syllables of content words, and at the edges of prosodic constituents (section 2.2.3). An intonational pitch accent is usually associated with the stressed syllable of all content words in the utterance (see section 2.2.4) and the most common utterance-final pitch contour observed is a fall. All of these properties are illustrated in the example in (2)(1) below.

In Mawng, questions usually have the same low boundary tone as statements, as we find in most Australian languages. Capell & Hinch (1970) give examples of Mawng questions and imperatives with final tone of pitch level 3, which we take to be equivalent to H%. However, in our dataset most questions have a L% boundary, as illustrated in (2) below, with a H* accent on the question word or on another focussed word (cf. Bishop (2002:96), who notes that in both the Kuninjku and Manyalluk Mayali dialects of BGW the pitch accent peak is on the question word

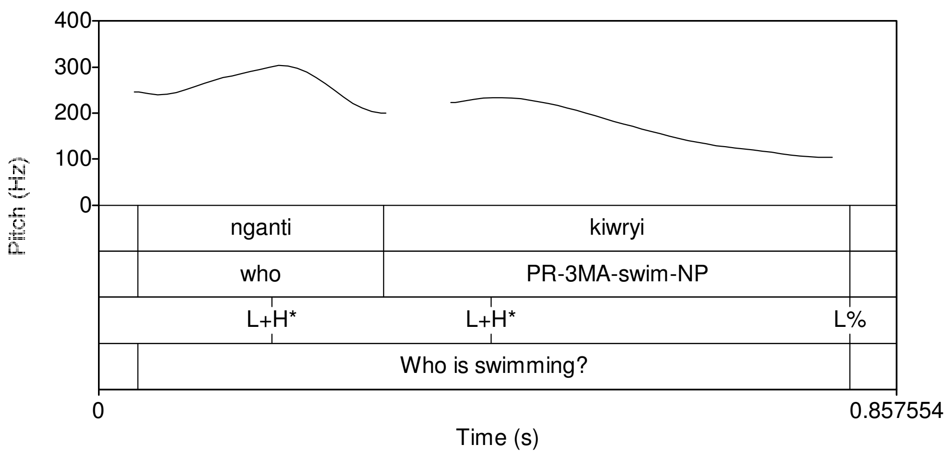
[1] Technically Bininj Gun-wok is a dialect chain (6 dialects) rather than a language as such (Evans 2003); we use the term 'language' here for simplicity.

in interrogatives). On the basis of the one or two examples of imperatives in our dataset we hypothesise that in Mawng imperatives are similar to questions, as in (3) below, though not identical (unlike in BGW, Bishop 2002).[2]

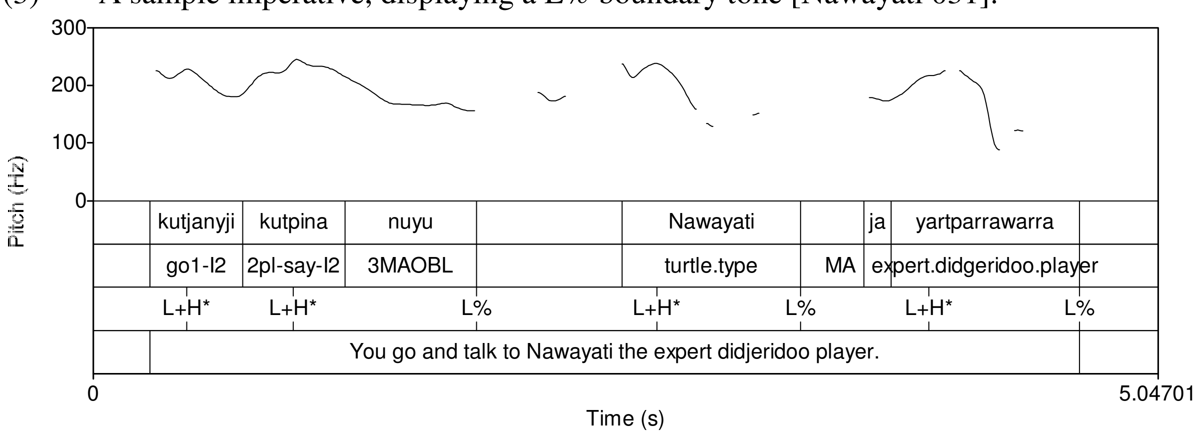
(1) Global declination pattern with utterance-final fall [mph-rs-2-39-13-2].



(2) A typical wh-question, displaying a L% boundary tone [mph-rs-4-26-36-Q].



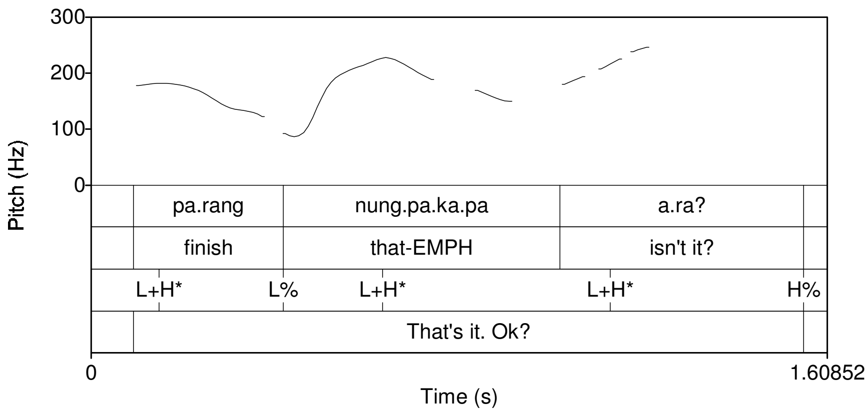
(3) A sample imperative, displaying a L% boundary tone [Nawayati 031].



[2] Map task data will be included in our systematic survey in order to clarify this point.

We have tried to discover what in our dataset might correspond to, or explain, the instances of use of phrase-final high pitch described by Capell & Hinch (1970). We observe one or two plausible examples of questions bearing a H% final boundary tone which rises relatively high. One such example occurs in a confirmation- or tag-question (4), and unfortunately due to the segmental context the pitch trace is not visible in the latter half of the phrase-final word – however the auditory impression is of (low) rising pitch after the stressed syllable.

(4) Low rising boundary in a tag question [Nawayati_087].



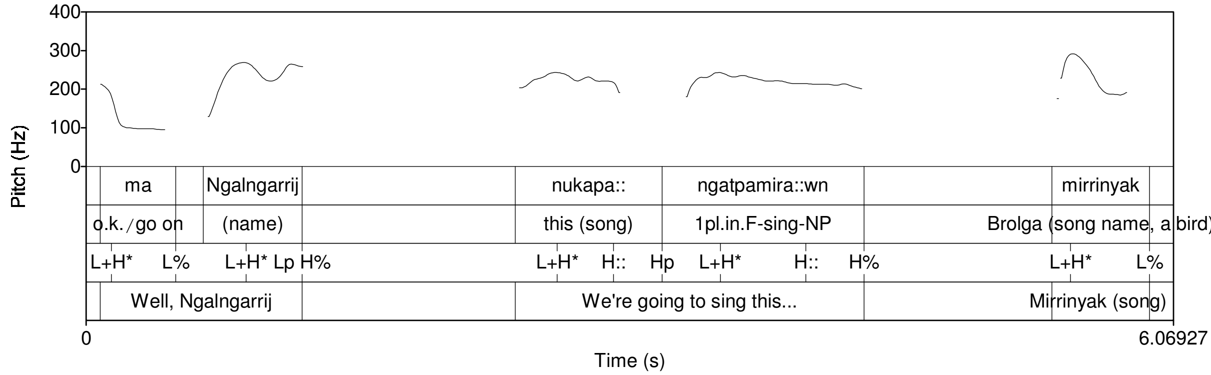
We also find a number of high final boundaries in narratives, as illustrated in (5) and (6) below. These high boundaries are mostly of two kinds: i) instances of the high sustained stylised boundary (H: H%) (Bishop 2002), discussed in more detail below; and, ii) a phrase-final fall-rise sequence, which seems to indicate open-endedness, inviting attention and/or signalling further content to come. The fall-rise sequence could be analysed as either a phrase tone-boundary tone combination (Lp H%), which is analytically consistent with Beckman & Elam (1993), or as a rising boundary tone (LH%), which is consistent with the analysis of BGW by Bishop & Fletcher (2005). At present we transcribe the fall-rise boundary as an Lp H% sequence.

Another context in which we see high final pitch is in cases where a high phrase- or boundary-tone marks the right edge of a topicalised constituent as shown in (7).

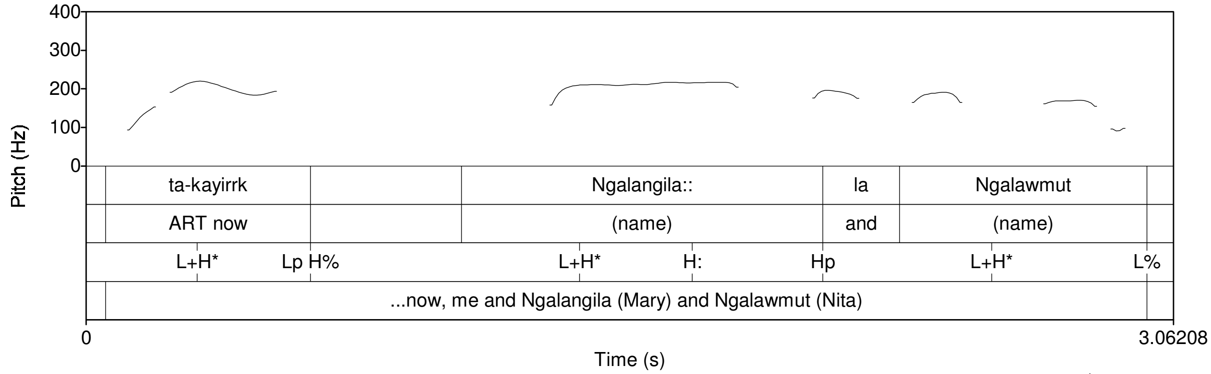
From the point of view of meaning, the most clearly defined use of phrase-final high pitch is the *stylised high sustained tone*, which is also observed in BGW and in a number of other non-Pama Njungan languagues (see Bishop 2002:89ff. for a summary). A prototypical example of use of the stylised high sustained tone is found in (8).[3] We adopt the notation of Bishop (2002) and label the sustained high morpheme 'H:'. The H: morpheme is usually followed by a high plateau continuing at the same pitch level, which we label as a high boundary (whether Hp or H%). An alternative (more transparent) notation of the boundary in these cases would be a zero boundary ('0%' or '0p'), however for the present we continue to transcribe these boundaries using Hp or H% (by analogy with use of H% in Bishop 2002, Bishop & Fletcher 2005).

[3] Further instances of the stylised high sustained tone used figuratively in the role of a narrator are found in (5) and (6) above; the example in (5) shows that the high tone plateau can spread over two adjacent words.

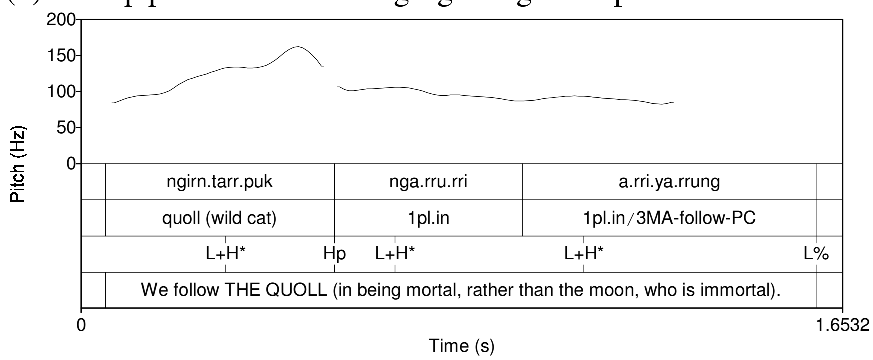
(5) Phrase-final fall-rise sequence in a sentence initial vocative phrase [Songs2_1-9_pt1].



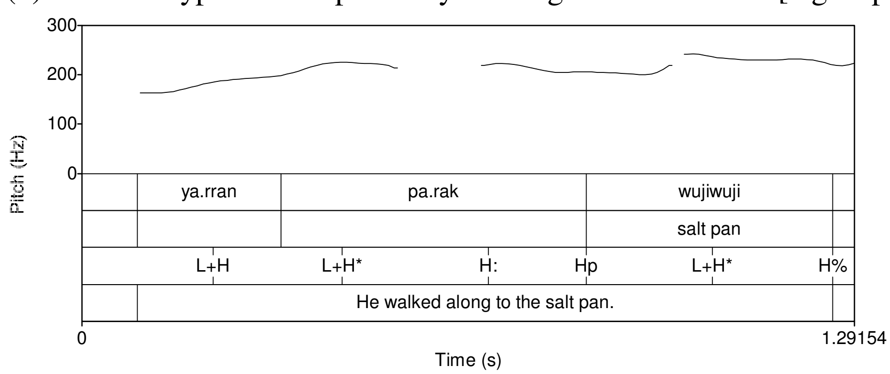
(6) Phrase-final fall-rise sequence in a sentence initial adverbial phrase [Songs2_1-9_pt2].



(7) Hp phrase tone marking right edge of topicalised constituent [Kurrana 045]. [4]



(8) Prototypical example of stylised high sustained tone [Nganaparru3_049a].



[4] In the translation we transcribe the noun phrase 'the Quoll' in capital letters to indicate that it is a contrastive topic.

2.2 Prosodic structure and tune-text association in Mawng

2.2.1 Word-level metrical prominence

Mawng is an intonational language which displays no lexical use of tone. This was noted already by Capell & Hinch (1970) who describe Mawng (implicitly) as a stress-accent language.

Mawng is a moderately polysynthetic language; the verbal template is illustrated in (9) below. Verbs take obligatory prefixes for subject and object and a suffix for tense/aspect/mood, and there are a few other non-obligatory morphemes that may occur within the verbal word, as well as various enclitics and particles that can combine phonologically with the verb. Verbs may also be complex: a *coverb* construction consists of an inflecting verb plus a non-inflecting verb which follows the verb and may form a single phonological word with it (depending on its length); in contrast, *converbs* are verbs which function as clause-linkers, but which also seem to form a single prosodic unit with a following verb, as discussed below.[5]

(9) The Mawng verb template (obligatory elements shown in bold).

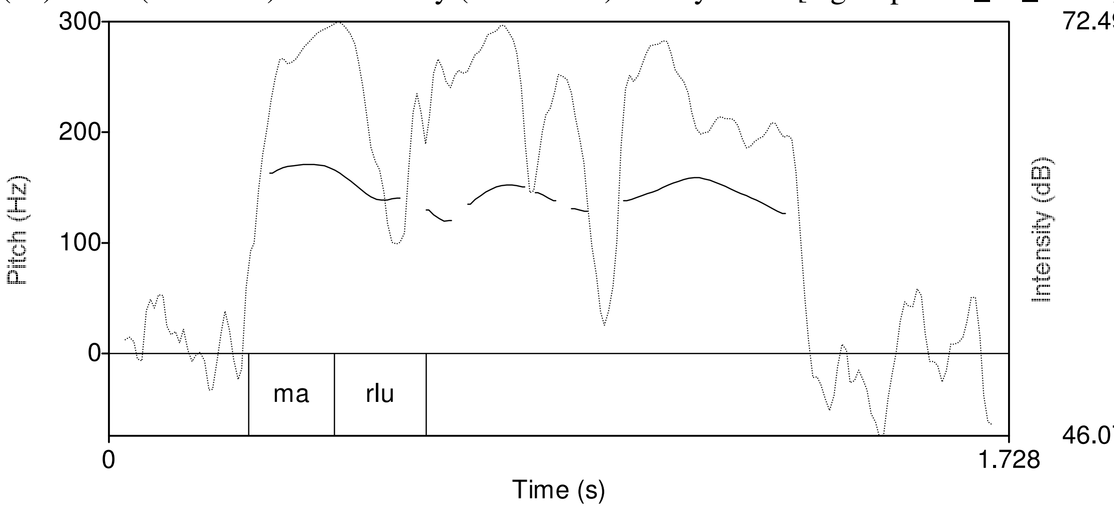
Negative particles	Person/number/gender/future prefix	Verb root	Iterative/durative reduplicative element	TAM suffixes	Coverb	Coverb reduplicant	Completive postverbal particle	Directional particles and suffixes	Emphatic suffix
marrik NEG *yunyi* NEG.IMP	**Verb prefix**	**verb root**	KRDP	**TAM suffix**	Coverb	RDP	*Yirrk* COMPL/ALL	*-ga* *warak* *-wi*	*-(a)pa* EMPH1
Negative particles	**Simple verb**				Coverb		Postverbal particles and suffixes		

The position of word-stress in Mawng interacts only to a limited extent with morphological structure, in contrast to BGW in which metrical structure is closely tied to morphological structure. Mawng verbs are more likely to be morphologically complex than nominals, since verbs bear obligatory prefixes and suffixes as noted above. In our dataset we find that in nouns the accent almost always falls on the leftmost foot (the first syllable of the root); the more difficult cases tend to be verbs as they are morphologically more complex, and can take heavier prefixes, and in these the position of stress is both more difficult to determine, and more variable, than in nominals.[6]

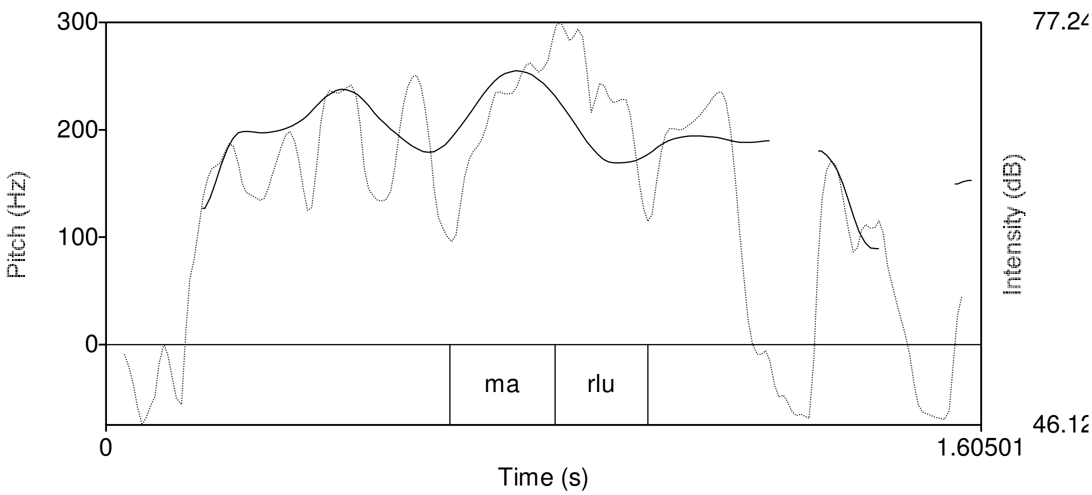
[5] For detailed discussion of coverbs and converbs in Mawng see Singer (2007).
[6] Only nominals and morphologically simplex verbs were included in the alignment study described in section 3.

From our observations in the present dataset we are able to formulate a number of preliminary generalisations about word stress in Mawng. Monosyllabic and disyllabic words always have initial stress. For example in both ‘marlu’ [ma.ɭu] “wind” and ‘murlirrk’ [mu.ɭirk] “shoulder” stress is on the initial syllable. The fact that a heavy syllable in non-initial position does not attract stress suggests that the Mawng stress system is quantity-insensitive[7], and leftmost stress indicates a trochaic foot type is used in building metrical structure. [8] In most disyllables, peak F0 and peak intensity fall within the same (initial) syllable, as in the instance of ‘marlu’ shown in (10). In other cases however, peak F0 is in the initial syllable but intensity peaks somewhat later, in the following syllable, as shown in the instance of ‘marlu’ shown in (11).

(10) F0 (solid line) and intensity (dotted line) in disyllable. [Nganaparru3_07_marlu].



(11) F0 (solid line) and intensity (dotted line) in disyllable. [Nganaparru3_011_marlu].



[7] Capell & Hinch (1970:27) suggest that stress assignment is quantity sensitive (being attracted to a heavy antepenult) in words of four or more syllables; their account is however very brief and does not take morphological structure into account.

[8] Compare genetically related Iwaidja, in which stress is based on bimoraic trochaic feet (Birch 2002), and BGW whose stress system is based on unbounded trochaic feet (Bishop 2003).

The details of the phonetic correlates of stress become even more relevant in trisyllabic words. In our dataset, we observe that in trisyllabic words stress falls regularly on either the first or second syllable. However the position of stress is often hard to perceive in these words since F0 and intensity peaks quite often fall on different syllables (within the first two syllables). When elicited in 'citation form' trisyllabic words are subject to variation both within the speech of a single speaker and between speakers in the position of stress, and whether or not the intensity and F0 peaks fall in the same syllable. The process is also productive, since a trisyllabic loanword English proper name such as 'Amanda' is treated differently on different occasions by different speakers, with stress on either the first or second syllable.

This apparently complex situation is nonetheless consistent with the brief description of stress in Mawng given by Capell & Hinch (1970) who note that in words up to three syllables "the first two syllables … tend to be *equally stressed*" (italics ours), and variability in stress position has been noted for monomorphemic polysyllabic words in Iwaidja (Birch 2003). A formal study of the phonetic correlates of stress in Mawng is therefore needed, but is beyond the scope of the present study. The phonetic correlates of word-stress in the genetically related language Iwaidja have been shown to include non-pitch properties; specifically, there is evidence of vowel centralisation in unstressed syllables in Iwaidja, when compared with stressed (but not accented) syllables (Birch 2002). This contrasts with BGW for which it has been argued that the only consistent phonetic correlate of word-stress is F0, perceived as pitch (Bishop 2003). Our informal observations of F0 and intensity patterns in the present Mawng dataset suggest that the F0 and intensity peaks within a word do not obligatorily fall within the same syllable. By analogy with Bishop's findings for BGW then, we adopt here the interim working hypothesis that the most consistent phonetic correlate of word-stress in Mawng is F0. Words of four syllables or longer in Mawng tend to have two stresses, on both initial and penultimate syllables (of the word or root). It appears to vary from word to word which of these two stresses is the primary stress, and since we have only a limited number of such tokens in our present dataset we leave further investigation of this issue to future study. For the purposes of the remainder of the analysis presented here, and in particular for the alignment study presented in section 3, we assume initial stress assignment in Mawng, and set aside problematic cases in which stress position is not easily determined.

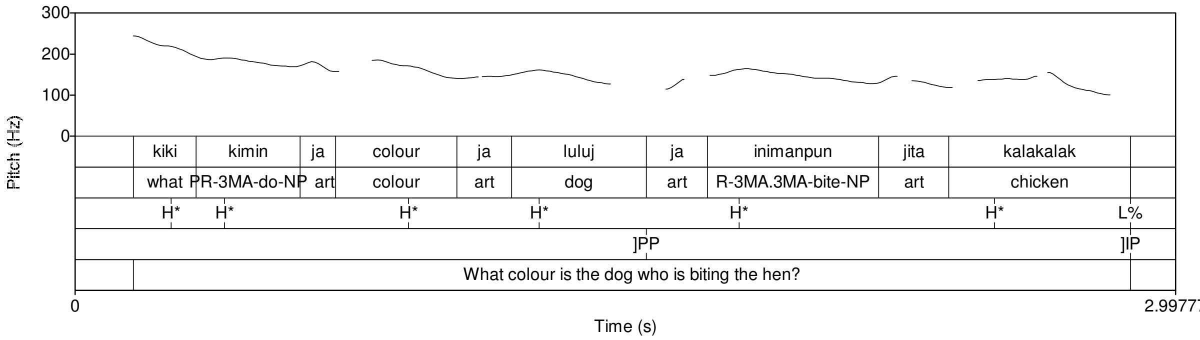
2.2.2 Prosodic phrasing in Mawng

Our preliminary survey indicates some evidence of an intermediate level of phrasing between the Prosodic Word (PWd) and the Intonational Phrase (IP), marked by means of local pitch reset and/or suspension of the regular downstep pattern. The example in (12) below shows a local pitch reset in the middle of a larger prosodic phrase; we analyse this as a single IP divided into two Phonological Phrases (PP). In this instance therefore, the PP phrase-break is cued by means of local pitch reset only, with no tonal marking of the PP edge. There are however examples of utterance-internal phrase breaks which are tonally marked, such as that shown in (7) above which bears a rising phrase tone (Hp), which we would also analyse as a PP-level break. Similarly we see utterance-internal phrase breaks which can be analysed as involving a low phrase tone (Lp), since the F0 contour falls immediately after the H peak, instead of falling steadily across unaccented syllables until the next accented word.[9] For the time being therefore

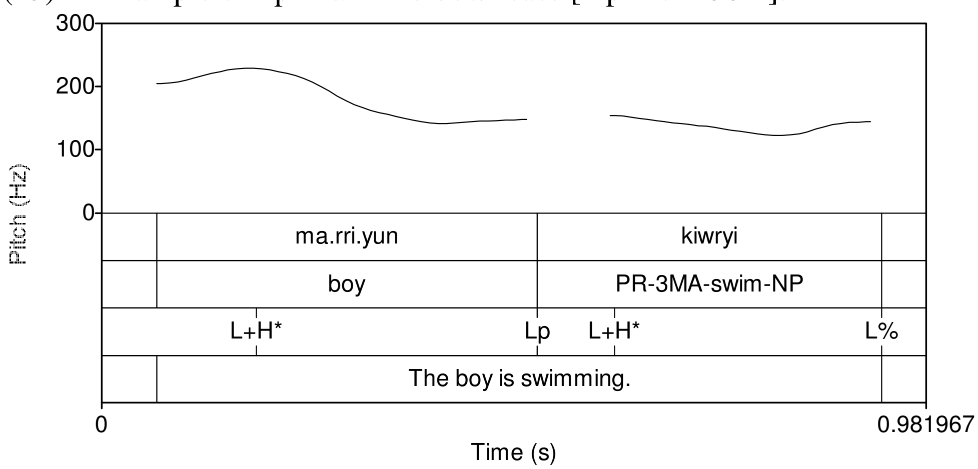
[9] These cases are also discussed below in the context of whether or not they should be analysed as a different pitch accent type (see section 2.2.3 below).

we acknowledge both PP and IP as relevant for analysis of Mawng, but remain agnostic as to whether the right edge of a PP is obligatorily marked with a phrase tone (L- or H-).

(12) Long IP with internal phrase-break indicated by local pitch reset. [mph-rs-4-23-6-Q]



(13) Example of Lp in an ‘L-elbow’ case [mph-rs-4-38-1].

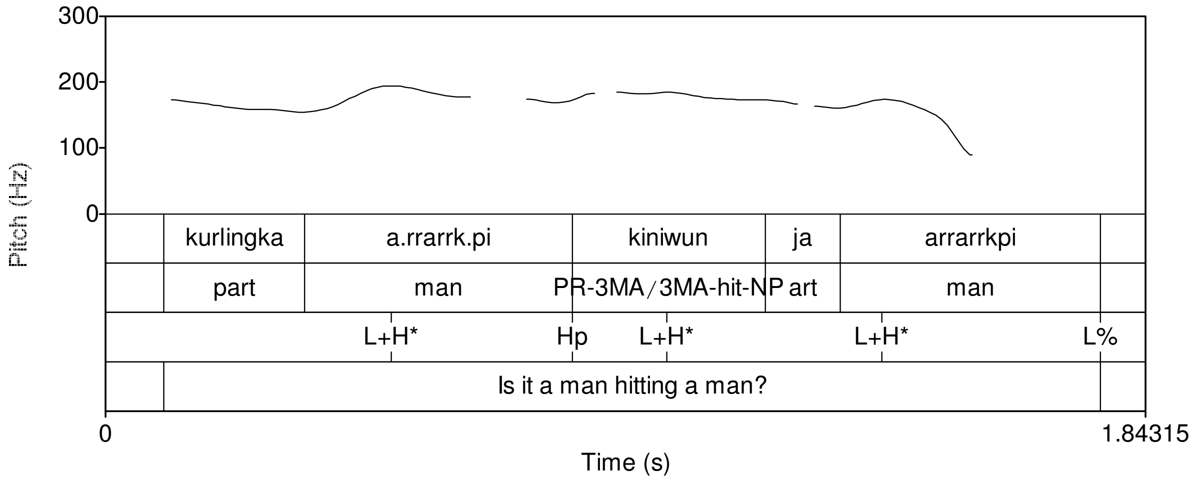


As for the distribution of phrase boundaries in Mawng, we are as yet unable to give comprehensive phrasing generalisations. Most of the phrase boundaries that we see are at relatively major (clause level) syntactic juncture points, such as after a topic (see (7) above). A similar example is illustrated in (14) below which shows a tonally marked prosodic juncture (Hp) after a fronted argument. However we also find tonally marked juncture (Lp) at a more minor syntactic juncture point, namely after the subject in a subject+verb sequence, as shown in (15). We suggest that the tonal marking here is an indication that the subject has in this case been (vacuously) fronted, and is perhaps topicalised (cf. (7)(13) above, which is a clear case of topicalisation). A more systematic survey will investigate what proportion of subjects and predicates are separated by prosodic juncture in this way.

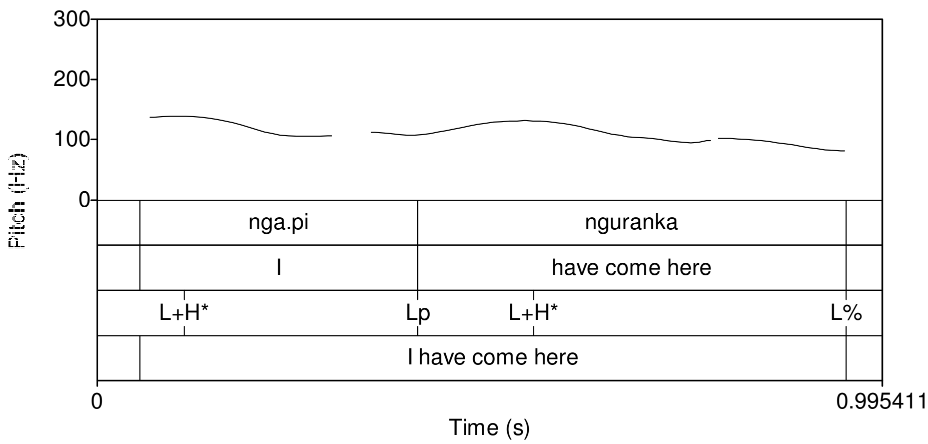
Capell & Hinch (1970) mention a number of sandhi process that take place at word boundaries, including vowel assimilation and consonant lenition after a vowel-final word (e.g. *ke kapala* > *ke gapala*) and consonant sandhi processes will also be investigated in a future corpus survey.[10]

[10] Sandhi processes are also noted for Iwaidja (Evans 2000).

(14) Example of slight juncture after a fronted wh-word + argument [mph-rs-3-41-9-Q].



(15) Example of minor prosodic juncture after a subject [Missionary1_020].



2.2.3 Inventory of pitch accents and boundary tones in Mawng

We observe a single tonal shape on all accented words in Mawng, consisting of a rise to a peak, with the peak situated in or just after the stressed syllable; the F0 contour then usually falls steadily across following unstressed syllables. We analyse this single pitch accent at present as L+H* for the following reasons: i) we observe that the onset of the rise regularly coincides with the onset of the accented syllable (whether word- or root-initial) thus we are dealing with a bitonal accent with a clear L target; ii) the most salient percept of the accent is the H peak, and we assign the 'starred tone' to the most salient of the two targets in the bitonal accent, that is, to the H, following Prieto et al (2006). See also section 3 below for discussion of how patterns of tonal alignment in our corpus can be understood in relation to this choice of phonological representation.

There are two plausible candidates for additional pitch accents in the Mawng inventory, both of which we reject. Firstly, a different tonal shape is observed in what we term the 'special pitch accent', observed in certain focus contexts, and which we investigate in detail in section 3 on the basis of alignment and F0 scaling evidence from the corpus. That evidence suggests that the special focus pitch accent is best analysed as a hyperarticulated instance of the main L+H* pitch accent, rather than as a separate phonological category. Secondly, there are a small number of instances in our corpus in which pitch does not fall steadily across unstressed syllables after the peak but instead falls rather sharply, forming an ‘L-elbow’. These could plausibly be analysed as a falling H*+L accent, in opposition to the main L+H* accent. However we note that these cases always involve a phrase-break of the intermediate variety discussed above, and we hypothesise therefore that these are instances of a tonally marked intermediate phrase, with some degree of leftwards-spreading of the L- phrase tone to create an ‘L elbow’ (see (13) above).

We therefore posit a single pitch accent in the inventory of Mawng: L+H*. Bishop & Fletcher (2005) similarly show that BGW dialects have in general a very reduced inventory of pitch accents (only two accents are proposed: H* and L+H*[11]), and they note that a highly reduced pitch accent inventory has also been proposed for Dyirbal, in which a single tonal tune is observed associated with all tonally marked stressed syllables: LH*L (King 1994, cited in Bishop & Fletcher 2005).

Turning to demarcative tones, as noted above we see a number of instances in our corpus in which it is appropriate to posit an Lp phrase tone; it is less obvious that a parallel Hp phrase tone should necessarily be posited. The context in which we most consistently observe an ‘intermediate’ tonally marked boundary is after a fronted and/or topicalised argument. At present we analyse these as instances of a Hp phrase tone (marking the right edge of an IP-internal intermediate phrase level), and thus propose both Hp and Lp in the Mawng tonal inventory. However it is possible that these are instances of IP boundaries, marked with H%, and thus that Mawng has a low phrase tone but no high phrase tone, as has been observed for the Kuninjku dialect of BGW (Bishop 2002, Bishop & Fletcher 2005). In addition to L% and H% IP-final boundary tones we also observe a complex rise-fall-rise boundary tone pattern in a small number of cases in our dataset. This pattern is parallel in form to the LH% boundary tone proposed for BGW (Bishop & Fletcher 2005). An alternative analysis of this pattern would be as a complex boundary tone combination, in which a high phrase tone (Hp) is followed by a low boundary tone (L%). Additional investigation in a wider corpus is needed to clarify which of these analyses is correct for Mawng.

At present therefore we posit the following inventory of tonal events in Mawng: L+H*, L-, H-, L% and H%.

2.2.4 Tune-text association in Mawng

In most cases there is a pitch accent on every content word in Mawng; that is, on all verbs, nouns, adverbs and adjectives; non-clitic function words are usually unaccented (see for example (12) above). We do however observe occasional exceptions to the normal one-to-one mapping between words and accents.

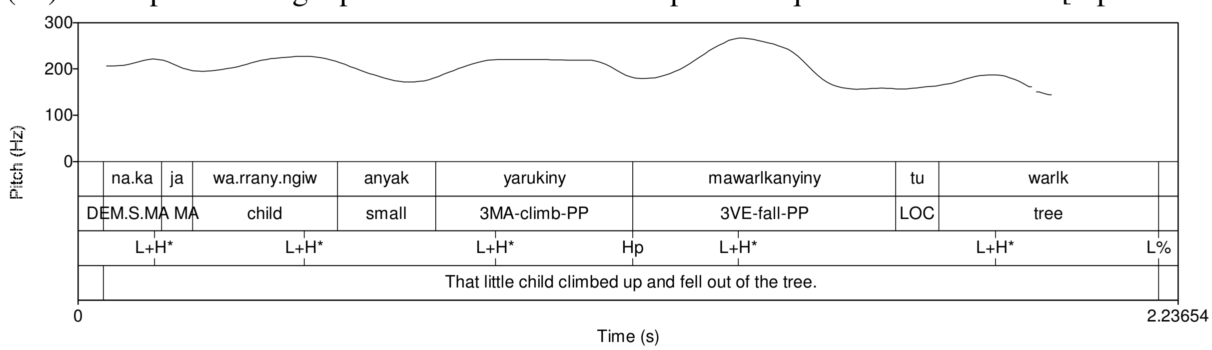
Bishop and Fletcher (2005) note that in BGW a word may bear two or even three pitch accents; in a word bearing two pitch accents this indicates that the word contains two feet (in BGW there is an almost one-to-one mapping between feet and morphological stems). Mawng is, in contrast to BGW, only weakly polysynthetic, but we nonetheless observe one or two cases where a word bears more than one pitch accent, and given the small number found in our present dataset we

[11] Assuming ‘H*<’ “delayed high” to be a sub-type of H*.

leave open for future for future research whether these additional stresses should be considered as instances of primary stress, whose distribution patterns similarly to assignment of stress in simplex words, or as an instance of rhythmic secondary stress. If more cases are found in a larger corpus we might wish to analyse the distribution of pitch accents in Mawng as linked directly to the distribution of feet, as in BGW.

We observe (rather more) cases in which two words appear to prosodically 'merge' so that only one bears an accent. These cases appear always to occur on 'compound' or complex constructions, such as the nominal sequence illustrated in (16) below. In example (16) a four-word noun phrase has only two pitch accents. The demonstrative plus article *naka ja* merge prosodically, which we might expect, since the article is a function word, but so do the two content words in the noun plus modifier sequence *warranyngiw anyak* 'small child'. Other cases of merging involve converbs, which, as noted above, are verbs which function as clause-linkers and form a prosodic sequence with a following verb which bears a single pitch accent. For now we adopt the working hypothesis that every Prosodic Word is Mawng bears a pitch accent, and thus that compound cases form a single PWd.

(16) Example of a single pitch accent within a compound sequence of two nouns [mph-rs-2-8-1].



3 The tonal alignment and scaling properties of Mawng pitch accents

3.1 Background to the study

In Mawng, the presence of a pitch accent on a word does not by itself indicate information status, since, in general, all nouns and verbs bear a pitch accent. However the use of steep pitch excursions in contexts of contrastive focus suggest that a 'special pitch accent' is available as one means of encoding focus in Mawng.

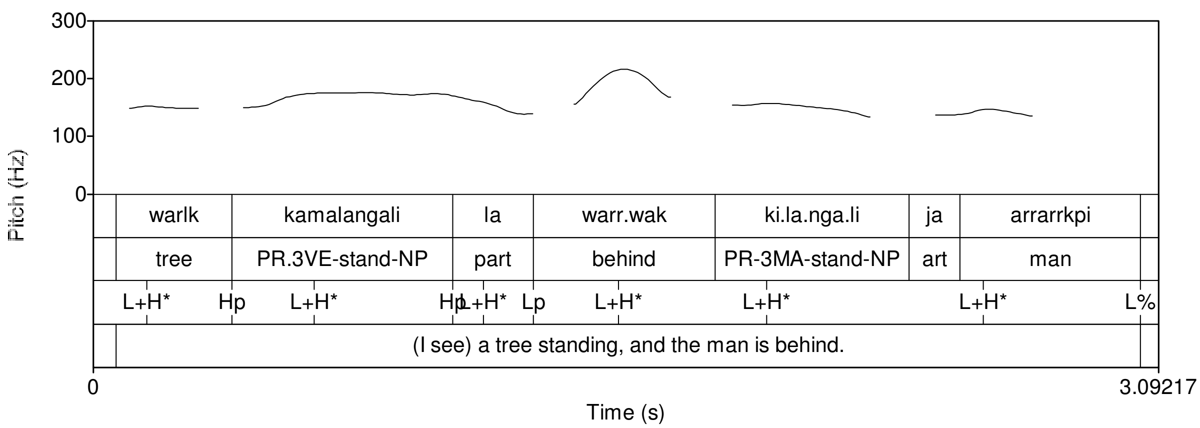
In this section we present the results of a quantitative study of alignment and F0 scaling in Mawng pitch accents of both the 'neutral' and 'focus' types. The purpose of the study was to obtain alignment generalisations for the position of the H peak in the Mawng pitch accent in both non-focus and focus variants and in different syllable types (open vs. closed). These generalisations enable us to propose an appropriate phonological representation for the main pitch accent and to determine whether or not the special 'focus' variant should be analysed as a separate phonological category.

Particular methodological issues must be faced in obtaining alignment generalisation in an unwritten, endangered language. In most European languages whose intonation has been studied in detail, the alignment and scaling of pitch accents has been investigated by means of experimental studies using carefully controlled stimuli presented to speakers in written form, and alignment properties observed in 'lab' speech studies of this type have been shown to be parallel to those observed in semi-spontaneous speech (Lickley *et al.* 2006). Collection of controlled data of this type is problematic in an unwritten language, although not impossible, but it is an open question whether 'lab' speech recordings are of sufficient value to a speech community whose language is endangered to warrant their collection over and above more naturalistic materials.

The ideal solution would be to establish alignment and scaling properties on the basis of naturalistic or (semi-)spontaneous data. However, intonational phonologists have relied on carefully controlled stimuli for good reason since the scaling and alignment of intonational pitch peaks is known to be influenced by a wide range of factors in the surrounding environment. For example, F0 is likely to be affected by variation across target words in both intrinsic and phonological vowel length (Steele 1986, House 1989) and in duration and voicing of consonants (Rietveld & Gussenhoven 1995). At the prosodic level, variation in syllable type (Ladd *et al.* 2000, Hellmuth 2006b), proximity of a prosodic boundary (Steele 1986, Silverman & Pierrehumbert 1990, Prieto *et al.* 1995) and stress clash (Silverman & Pierrehumbert 1990) are all known to influence peak alignment. A few studies have attempted to filter out the influence of these factors in quantitative studies of F0 alignment in (semi-) spontaneous speech (Wichmann & House 1996, Peters 1999, cf. also Kügler 2005). For example, Peters (1999) pre-selects tokens from a large base corpus so that they are roughly uniform (sonorant open syllables bearing a nuclear H*) and categorises each token according to a list of factors which are then used in a multiple regression analysis to determine their influence on peak alignment. His overall findings yield generalisations about inter-dialectal differences in peak alignment in German. The study outlined below seeks to implement similar methodology, as described in section 3.2, with the results presented in section 3.3, and discussion of the interpretation and implications of the findings in section 3.4.

The existence of the 'special pitch accent' in Mawng was noted already in Singer (2006b). It is characterised by a much steeper F0 rise on the stressed syllable of the accented word, as illustrated in (17) which shows a 'special focus accent' in the word 'warrwak' [war.wak] "behind", with 'neutral' accents on other adjacent words (compare also (3) above, which contains an example of a 'special pitch accent' in the last phrase).

(17) Example of 'special pitch accent' on 'warrwak' [mph-rs-1-39-9-1].



The special accent usually marks a contrastive focus (as in (17) which appears in a sequence of locative descriptions in which the man was previously in front of the tree), but is also observed in non-contrastive focal contexts (such as introduction of a new referent to discourse). It is however not the only means available to indicate a contrastive (or other) focus in Mawng, which also employs word order variation and (to some extent) an emphatic marker ('pa').[12]

Bishop and Fletcher (2005) mention a special L+H* tone used in the Gundjeihmi dialect of Bininj Gun-wok to signal emphasis or narrow focus in narratives. However, Bishop (2002) describes relative pitch scaling as the main means of encoding focus and other aspects of information structure in Bininj Gun-wok. We hypothesise that the 'special focus accent' in Mawng differs from its 'neutral' counterpart in either alignment or scaling (or both). A difference in peak alignment would suggest a categorical difference of phonological representation (cf. Bishop & Fletcher 2005), whereas a difference of scaling would suggest that the special focus accent is of the same phonological category as its neutral counterpart, but produced in an expanded pitch range (cf. Hellmuth 2006a). Whilst the presence (or absence) of a categorical phonological distinction cannot be established from production data alone (a perception study would be needed) this study is a first step towards documenting the properties of this special pitch accent.

3.2 Methodology

Our source dataset for the quantitative study includes two types of data: i) semi-spontaneous data elicited in response to visual stimuli using the Questionnaire on Information Structure (Skopeteas *et al.* 2006); ii) spontaneous data from spoken narratives (Singer 2006a). The semi-spontaneous data includes a relatively large number of tokens elicited in focus contexts.

Each section of the corpus (elicited/spontaneous) was analysed auditorily, with reference to F0 and spectrogram extracted using Praat 4.2, in order to select suitable accented words as tokens for inclusion in the alignment study. A word was included in the study only if it was in non-phrase-final position and contained mostly sonorant or voiced segments in and around the accented syllable. In practice a number of words were included which contained a stop consonant in or near the accented syllable, which reduced our ability to measure the position of the L turning point at the start of the accented syllable in a number of cases (Mawng like most Australian languages has a single series of plosive consonants which lack a voicing contrast). The majority of included tokens are nominals, in which the position of word-level prominence is easier to determine; a small number of verbs in which the position of stress was clear were also included. Tokens were labelled by syllable type (V, CV and CVC) and focus status (an instance of the special pitch accent, '+ focus', or not, '-focus').

This selection process yielded 39 focus tokens and 153 'neutral' tokens. Although these token counts do not match the equal numbers of focus/non-focus tokens that one might obtain in an experimental study, this is a greater proportion of focus tokens than one might expect to find in a corpus of spontaneous speech only. We looked through approximately 800 Mawng utterances in order to obtain this set of 192 suitable tokens (540 elicited sentences + 10 texts of approximately 25 sentences each).

[12] See Singer (2007in preparation) for discussion of the interaction of syntax and prosody in the expression of information structure in Mawng.

Two levels of analysis were applied to the data. Firstly we wish to establish the peak alignment patterns of 'neutral' accents relative to the segmental string, in order to propose a suitable phonological representation for the Mawng pitch accent. Visually, we observe that the H peak falls either just inside or just after the end of the accented syllable, however we suspect that the distribution of peaks falling inside and just outside the accented syllable may depend on syllable type (open vs. closed). Our specific hypothesis therefore is that the H peak will consistently align outside the syllable in open syllables but within the syllable in closed syllables. We use a proportional measure of peak alignment (relative peak delay, as defined below) in order to avoid the effects of greater variance among absolute peak delay values (Schepman *et al.* 2006). Secondly, we wish to determine whether 'focus' accents differ from 'neutral' accents in alignment or scaling (or both). As dependent variables we use relative peak delay again, and a proportional measure of F0 scaling (normalised F0 excursion, as defined below). To derive the required dependent variables, segmental landmarks and pitch events (as in the table in 17) were labelled by hand in each of the 192 tokens identified as suitable for inclusion in the study. A Praat script was used to extract durational and F0 measurements from each token and from these to calculate dependent variables as set out in (19).

(18) Segmental landmarks and pitch events labelled in each token.

O	start and end of the onset consonant of the accented syllable (if present)
N	start and end of the nucleus of the accented syllable
C	start and end of the coda consonant of the accented syllable (if present)
H	F0 maximum turning point in or near the accented syllable
L	F0 minimum turning point before the H peak
pH	F0 maximum of the phrase in which the token is found
pL	F0 minimum of the phrase in which the token is found

(19) Calculation of dependent variables

pd	'peak delay' = distance from H peak to beginning of accented syllable
sylldur	duration of accented syllable
rpd	'relative peak delay' (pd/sylldur)
wxn	accented syllable F0 excursion in Hz ('F0 at H' – 'F0 at L')
pxn	phrasal F0 excursion in Hz ('F0 at pH' – 'F0 at pL')
zxn	normalised F0 excursion in Hz (wxn/pxn)

In order to be able to determine the degree of influence of external factors a count was made of the number of syllables from the accented syllable to the end of the word ('DistWEnd') and from the accented syllable to the next pitch accent ('NoIntSyll'). The position of the accented syllable within the word was also noted ('PosStress'). In addition the duration of the onset ('ODur') and coda ('CDur') were calculated (if present). All of these factors have been shown to affect the alignment of H peaks in pitch accents as discussed in section 3.1 above.

3.3 Results

Our tokens for analysis were selected from a corpus of spontaneous and semi-spontaneous speech, rather than being produced under experimental conditions, in which the environment around the target syllables is controlled. As a result, as expected, we have a non-homogenous dataset, with variation in the number of tokens per speaker, per syllable type and per focus condition. The table in (20) shows the overall token counts split by focus type, syllable type and speaker. In total, we have 153 'neutral' tokens and 39 'focus' tokens for analysis.

(20) Tokens counts by Focus, Speaker and Syllable Type

Focus			Speaker					Total
			MK	MM	NG	NN	SB	
- focus	Syllable Type	V	1	0	5	19	9	34
		CV	12	6	27	43	8	96
		CVC	3	0	8	10	2	23
	Total		16	6	40	72	19	153
+ focus	Syllable Type	V	2		0	2	0	4
		CV	5		3	11	1	20
		CVC	0		6	9	0	15
	Total		7		9	22	1	39

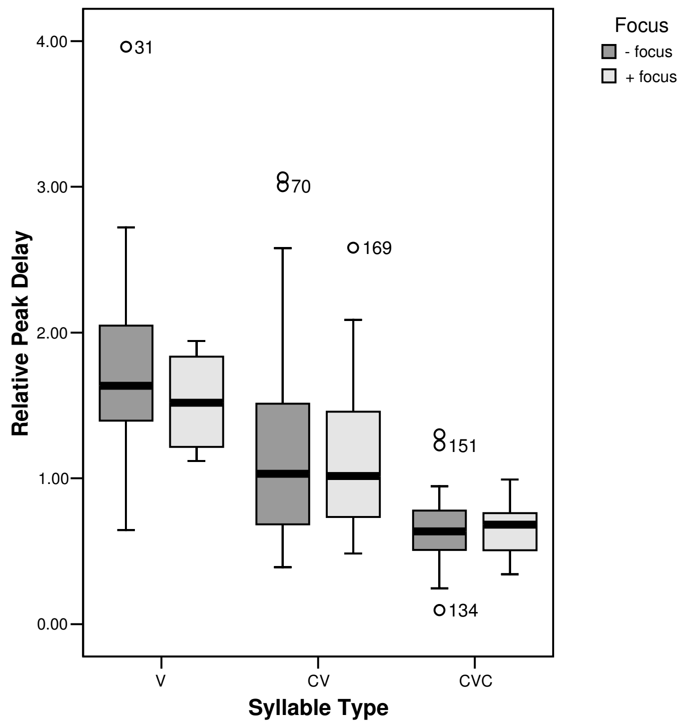
Our hypothesis regarding patterns of H peak alignment in the main Mawng pitch accent was that there would be consistent variation in peak alignment which can be related to the accented syllable type. The figure in (21) shows the median and interquartile range for values of rpd, by syllable type and by focus type. Although the data are relatively widely distributed (particularly in open syllables, V and CV) there is a clear difference in median values of rpd dependent on syllable type, and all of these differences are significant (as illustrated in (22) which provides 95% Confidence Intervals for values of rpd by syllable type and by focus type) and our hypothesis is thus confirmed.

Turning to the alignment and scaling properties of the 'focus' accent, it is again visually clear in in (21) that values of rpd are broadly similar within each syllable type, regardless of focus type, and any slight differences are not statistically significant.[13] The difference between the neutral and focus accents is not therefore a matter of alignment. As regards F0 scaling, (23) shows median and interquartile values of zxn (normalised F0 excursion) by syllable type and by focus type. It is clear that median values of zxn vary by focus type (and not by syllable type). The figure in (24) shows that the difference in values of zxn between +focus and –focus tokens is significant in CV syllables, though does not reach significant among CVC syllables (a subset of only 15 tokens). We believe that a larger pool of tokens, and thus a larger pool of CVC tokens, would yield an even clearer result. On the basis of the present dataset then, we infer that the Mawng 'focus' accent is characterised by increased F0 excursion only, and not by any significant difference in peak alignment relative to the segmental string.

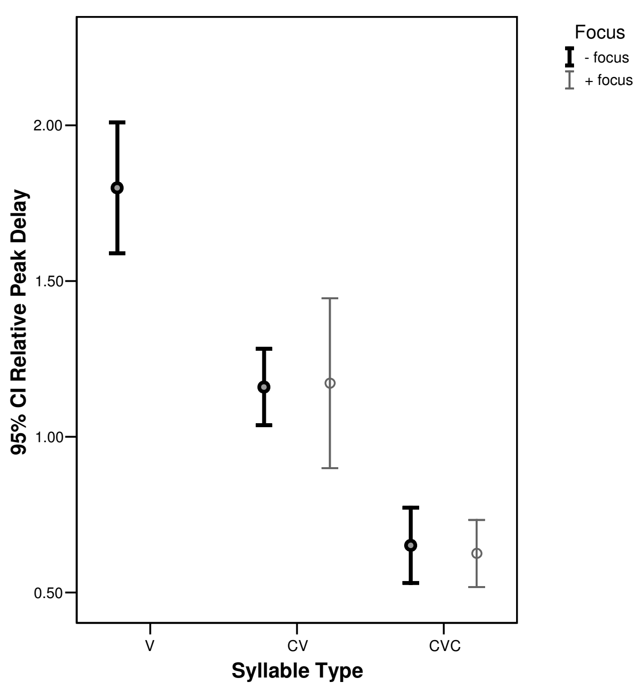
In order to determine whether these results could have been disproportionately affected by potentially factors in the prosodic environment (within different syllable types or different focus types), we ran a number of linear regression analyses with Speaker, DistWEnd, NoIntSyll, PosStress, ODur and CDur as potential predictors of rpd as dependent variable, within each subset of the data (see (25) & (26) below).

[13] There are only four focus tokens in the V syllable type category thus we exclude these from the 95% CI figure.

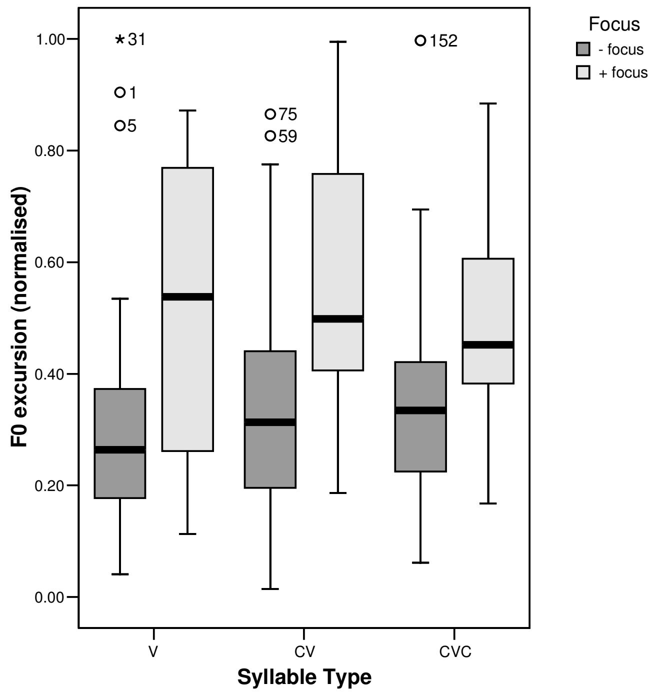
(21) Median and interquartile ranges values of relative peak delay (rpd), by syllable type and by focus type.



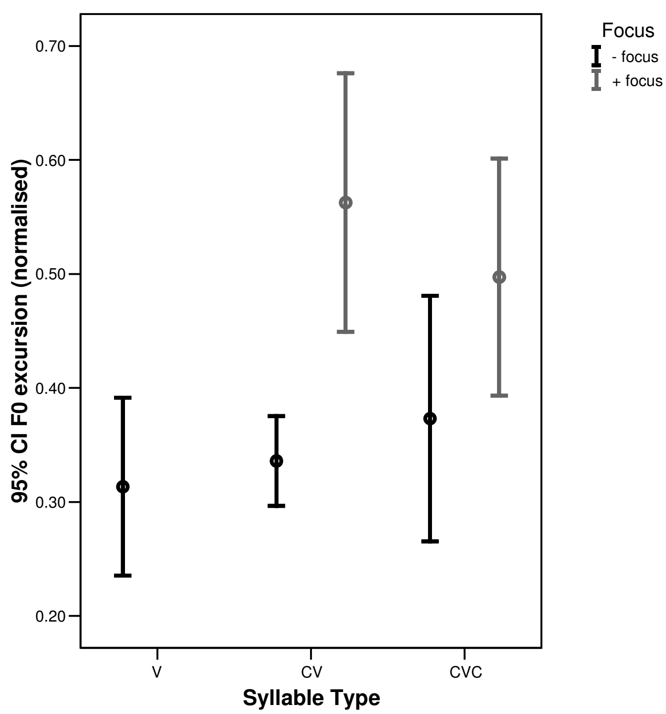
(22) 95% Confidence Intervals for values of relative peak delay (rpd), by syllable type and by focus type.



(23) Median and interquartile ranges values of normalised F0 excursion (zxn), by syllable type and by focus type.



(24) 95% Confidence Intervals for values of normalised F0 excursion (zxn), by syllable type and by focus type.



(25) Linear regression analysis of factors affecting relative peak delay, by syllable type.

		B	β	t	Sig t
V	Speaker	.168	.301	2.212	.034
	DistWend	.687	.658	3.902	.000
	NoIntSyll	-.011	-.019	-.118	.907
	PosStress	.148	.057	.416	.680
	(Constant)	-.452		-.674	.505
CV	Speaker	.069	.133	1.971	.051
	DistWend	.413	.582	6.186	.000
	NoIntSyll	-.005	-.010	-.104	.918
	PosStress	-.138	-.114	-1.713	.090
	Onset Duration	-.006	-.274	-4.002	.000
	(Constant)	.719		3.610	.000
CVC	Speaker	.047	.177	1.014	.319
	DistWend	.068	.200	.953	.348
	NoIntSyll	.015	.071	.391	.699
	PosStress	-.123	-.229	-1.386	.176
	Onset Duration	-.001	-.114	-.730	.471
	Coda Duration	-.003	-.330	-1.945	.061
	(Constant)	.772		3.071	.004

(26) Linear regression analysis of factors affecting relative peak delay, by focus type.

		B	β	t	Sig t
-focus	Speaker	.083	.137	2.552	.012
	DistWend	.377	.447	6.196	.000
	NoIntSyll	.027	.046	.663	.508
	PosStress	-.202	-.135	-2.517	.013
	Onset Duration	-.007	-.334	-6.025	.000
	Coda Duration	-.004	-.140	-2.491	.014
	(Constant)	.775		3.971	.000
+focus	Speaker	.131	.281	2.738	.010
	DistWend	.442	.790	4.527	.000
	NoIntSyll	-.076	-.204	-1.294	.205
	PosStress	.070	.060	.646	.523
	Onset Duration	-.003	-.186	-1.790	.083
	Coda Duration	-.003	-.252	-2.395	.023
	(Constant)	.261		1.070	.292

The linear regression analyses within each syllable type subset indicate that in our present dataset the potentially influencing factors have more of an effect among V and CV syllables (open syllables) than among CVC syllables: within the subset of V syllables, only Speaker and DistWEnd are significant factors; among V and CV syllables, Speaker, DistWEnd and (in CV only) ODur are factors; in contrast, among CVC syllables none of the tested factors contribute significantly to the model. At present we interpret this difference as an artefact of the considerably smaller number of CVC syllables in our dataset (total N=38), compared to open (V and CV) syllables (total N = 154) (see (20) for details). We hypothesise that the effect of influencing factors in CVC syllables would be more parallel in a larger dataset, however our claims regarding H alignment in different syllable types must for the time being remain tentative pending investigation in a larger dataset.

In contrast, a linear regression within each focus type indicates that the effects of influencing factors are evenly distributed between the two sub-datasets; all factors are significant in both focus subsets, except for NoIntSyll, which significantly affects values of rpd in –focus tokens only.

3.4 Discussion

With respect to the main Mawng pitch accent, our hypothesis that the H peak falls inside the syllable in closed syllables but outside the syllable in open syllables, was confirmed, although we acknowledge that this result needs to be reproduced in a larger dataset (with a more even distribution of tokens across syllable types).

How are we to interpret the different alignment of H in different syllable types? One possible interpretation is that the positioning of the H peak is positioned relative to some domain larger than the stressed syllable, such as the stressed foot (Hellmuth 2007). Since we did not label the end of the foot in our current dataset we are not able to test whether a measure of rpd, relative to the foot, is a more uniform predictor of H position across syllable types than rpd relative to the accented syllable. It has also been observed that the alignment of syllable-final pitch targets is variable due to articulatory effects (Prieto & Torreira 2006).

An alternative explanation of the increasing values of rpd from CVC through CV to V syllables is that the H peak is simply aligned at a fixed duration after the onset of the stressed syllable, regardless of syllable type. This would be consistent with an analysis in which the F0 movement observed on every PWd in Mawng is not a pitch accent (associated with the stressed syllable) but a rising word-level phrase tone, anchored at the left edge of the PWd (‘LH_w’). We are not able to exclude this alternative analysis, since a test of the relationship between peak delay (pd) and syllable duration (sylldur) shows no correlation (Pearson’s correlation coefficient = 0.083; p=0.254; $\alpha = 0.05$). Indeed a pair of one-way ANOVAs of mean values of peak delay across syllable types, run within each focus type separately, show that mean values of peak delay do not vary across syllable types, in either focus type (-focus: $F(150,2) = 1.463$; p= 0.235; +focus: $F(36,2)= 0.149$; p=0.862). We hope to disambiguate between these two potential analyses via study of a larger, more homogenous dataset. For the present we continue to analyse the main Mawng F0 movement as a pitch accent (L+H*) by analogy with analysis of regular F0 movements in both Iwaidja and BGW as pitch accents.[14]

[14] We note however that a phrase-tone-only analysis is proposed for Dalabon (Fletcher 2007).

Under either scenario however, these quantitative generalisations enable us to incorporate into our main analysis the many instances of 'delayed peak' tones in which the H peak falls after the end of the stressed syllable. In their analysis of BGW, Bishop & Fletcher (2005) transcribe such cases as a separate pitch accent type ("delayed high", 'H*<'). Our data indicate that in Mawng this pattern is predictable from prosodic context and thus that 'delayed peak' tones should be seen not as a different category of pitch accent but as 'allophonic' variants of either the main L+H* accent or of an eventual word-level phrase-initial tone LH_w (constrained to occur in word-initial, and possibly also root-initial, open syllables). The three 'delayed high' cases provided by way of illustration in Bishop & Fletcher (2005) are all found on (word-initial) open syllables ('namak', 'bayidurhdurndi' and 'nyale', pp336-339), suggesting that it may be possible to extend this analysis also to BGW.

We are able to make more concrete claims about the patterning of alignment and scaling in focus vs. non-focus tokens. Our quantitative study found that the Mawng 'special focus accent' differs from its neutral counterpart in scaling but not in alignment. We therefore analyse the 'special focus accent' not as a separate phonological category but instead as a hyperarticulated variant of the standard L+H* main pitch accent. We can liken this to use of contrastive modifications of the tonal space (pitch register) observed by Bishop (2002:17) in BGW: Bishop's findings for BGW, obtained through qualitative observation, match ours obtained for Mawng through quantitative study. [15] Similar effects in English have also been known for some time, although there has been much debate as to whether the effect should be interpreted as phonologically categorical or gradient (Ladd 1994, Hayes 1994, Ladd 1996). A practical question that arises is how this accent should be transcribed, since it is clearly useful to note when a speaker uses a 'focus accent'; we suggest that, in a future fully articulated transcription system for Mawng, instances of the focus accent should be transcribed as such on a Misc tier.

Finally, Bishop (2002:198) finds that there is no post-focal deaccenting in Kuninjku, and thus no clear distinction between a contour with a focus on the initial word and a normal downstepping broad focus contour. We suggest that this is also true of many Mawng utterances, since the 'focus accent' does not obligatorily mark every instance of focus. However in cases where the pitch excursion of the focussed initial word is extreme, that is, the cases which we would analyse as instances of the 'special focus accent', our expectation would be that speakers would be able to perceive a difference between narrow focus and broad focus contours. Exploration of this possibility, must remain at present for future study, in the context of investigation of other means of expression of information structure in Mawng.

[15] Use of pitch range compression and expansion is also noted in Iwaidja by Birch (2003).

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